

NATIONAL COMMUNICABLE DISEASE CENTER

MALARIA

SURVEILLANCE

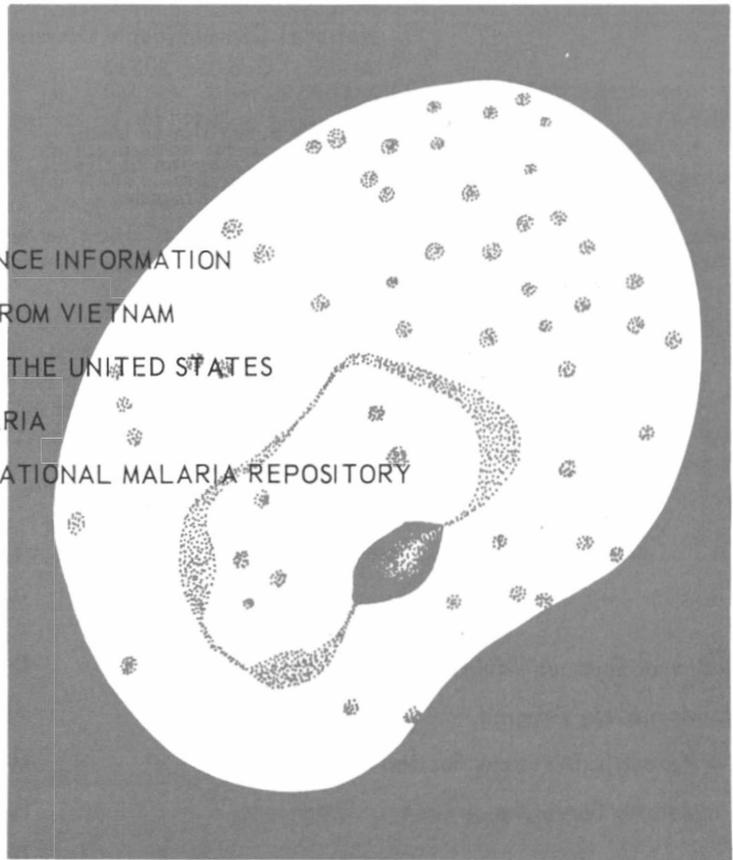
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PREFACE

This report summarizes information received from State Health Departments, Medical Departments of the Armed Forces, and other pertinent sources. It is intended primarily for the use of those with responsibility for disease control activities. Anyone desiring to quote this report should contact the original investigator for confirmation and interpretation.

Contributions to the Surveillance Report are most welcome. Please address them to:

National Communicable Disease Center
Atlanta, Georgia 30333

Attn: Malaria Surveillance Unit
Parasitic Diseases Section
Epidemiology Program

National Communicable Disease Center
Epidemiology Program
Parasitic Diseases Section
Malaria Surveillance Unit

Statistics Section

Helminthology and Protozoology Unit
National Malaria Repository

David J. Sencer, M.D., Director
Alexander D. Langmuir, M.D., Chief
Myron G. Schultz, D.V.M., M.D., Chief
Hans O. Lobel, M.D., Chief
George U. Fisher, M.D.
Ida L. Sherman, M.S., Acting Chief
James C. Lastinger, M.S.
Mrs. Stella S. Sanford

Collaborators

George R. Healy, Ph.D., Chief
Neva N. Gleason, M.S., Supervisor

MALARIA SURVEILLANCE, 1967

I. SUMMARY

Malaria in the United States in 1967 was characterized by a marked increase of imported cases due to the return of military personnel from Vietnam. A total of 2,815 cases was reported, as compared with 678 cases in 1966, and 156 in 1965. All but 186 of the 2,815 cases had acquired their infection in Vietnam.

Plasmodium vivax was the predominant parasite species, accounting for 81 percent of the infections. P. falciparum was identified in 13 percent of the cases.

Despite the large number of imported cases, little evidence of spread in the United States was observed. Only two introduced cases and one case of post-transfusional malaria could be related to individuals who had acquired their infection in Vietnam. Four other cases were infected in the United States, including two infections following blood transfusion, one case of congenital malaria and one isolated case in which the source of the infection could not be determined.

Two fatal malaria cases, both due to P. falciparum, were reported in 1967.

II. TERMINOLOGY

The terminology used in this report is derived from the recommendations of the World Health Organization.^{1,2} The definitions of the following terms are included for reference purposes.

1. Autochthonous

- a) Indigenous - malaria acquired by mosquito transmission in an area where malaria is a regular occurrence.
- b) Introduced - malaria acquired by mosquito transmission contracted from an imported case in an area where malaria is not a regular occurrence.

2. Imported

Malaria acquired outside of a specific area (United States and Puerto Rico in this report).

3. Induced

Malaria acquired through artificial means, i.e., blood transfusion, common syringes, malariotherapy.

4. Relapsing

Renewal of clinical activity occurring after an interval from the primary attack greater than that due merely to periodicity.

5. Cryptic

An isolated case of malaria not associated with secondary cases, as determined through appropriate epidemiological investigation.

III. GENERAL SURVEILLANCE INFORMATION

Epidemiologic reports on 2,815 cases of malaria with onset of illness in 1967 in the United States and Puerto Rico were received by the Malaria Surveillance Unit of the National Communicable Disease Center. This is the largest number of malaria cases recorded in the United States for any year since 1952. Military personnel (including recently discharged veterans) accounted for 2,669 cases, while 146 additional cases were reported in civilians (Table I). In the decade, 1956-1965, an average of only 108 cases per year were reported; this rose to 678 cases in 1966, and 2,815 cases in 1967. The number of military cases has increased markedly since 1965, while civilian cases have increased only slightly (Figure 1). Only seven of the 2,815 cases in 1967 acquired their infection in the United States. These were classified as introduced, two cases; congenital, one; induced, three; and cryptic, one case. These cases are described in Section V.

There is no established seasonal or geographic pattern for malaria in the United States, since virtually all cases are imported. The marked concentration of cases

in some states, California, Colorado, Georgia, Kentucky, North Carolina, and Texas is due to the location of major military centers. (Figure 2)

The Plasmodium species was identified in 2,735 of the 2,815 cases (97.2 percent). P. vivax accounted for 81 percent of the infections, while P. falciparum was diagnosed in only 13 percent. The corresponding figures for 1966 were 56 percent and 33 percent, respectively. P. ovale accounted for 18 cases in 1967, while 19 infections were due to P. malariae. This compares with 13 cases of P. ovale and 12 cases of P. malariae in 1966.

In total, 1,323 of the 2,808 imported cases gave a history of malaria while abroad (47.1 percent); 1,353 cases had no such history (48.2 percent); and in 132 cases no information about previous malaria was available.

Table I
Military and Civilian Cases of Malaria
United States 1958-1967*

Year	Military	Civilian	Total
1958	33	37	70
1959	12	38	50
1960	21	41	62
1961	45	37	82
1962	75	40	115
1963	58	90	148
1964	52	119	171
1965	51	105	156
1966	563	115	678
1967	2669	146	2815

*Onset of illness in the United States and Puerto Rico

Table II
Cases of Malaria by Plasmodium Species
United States, 1967

Species	Total	Percent
<u>P. vivax</u>	2290	81.3
<u>P. falciparum</u>	362	12.9
<u>P. malariae</u>	19	0.7
<u>P. ovale</u>	18	0.6
Mixed Infections	46	1.6
Undetermined	80	2.8
Total	2815	100.0

Eighty percent of all cases occurred in males in the 20-29 year age group, reflecting the large number of military cases (Table III). Females accounted for only 29 percent of the reported nonmilitary cases.

Table III
Age and Sex Distribution of Cases of Malaria
United States, 1967

Age Group	Total Cases				Nonmilitary Cases			
	Male	Female	Total	Percent	Male	Female	Total	Percent
0-9	5	6	11	0.4	5	6	11	7.5
10-19	232	1	233	8.3	12	1	13	8.9
20-29	2245	19	2264	80.4	47	19	66	45.2
30-39	211	6	217	7.7	16	6	22	15.1
40-49	28	4	32	1.1	9	4	13	8.9
50-59	9	3	12	0.4	9	3	12	8.2
60-69	3	2	5	0.2	3	2	5	3.4
70+	1	-	1	0.04	1	-	1	0.7
Unknown	39	1	40	1.4	2	1	3	2.1
Total	2773	42	2815	(100.0)	104	42	146	(100.0)

Two categories, former Peace Corps Volunteers and foreign visitors to the United States, accounted for 48 percent of the 146 civilian cases:

- a) Twenty-one cases occurred in former Peace Corps Volunteers as compared with 30 in 1966, 17 in 1965, and 5 in 1964. All but two of these 21 individuals had been stationed in West Africa. P. vivax was the etiologic agent in 12 cases, P. ovale in 7 cases, and in 2 cases the parasite species was not identified.
- b) Forty-nine malaria cases were reported in foreign visitors to the United States. This compares with 30 such cases in 1966 and 19 in 1965. Seventeen of these 49 cases were students and 12 cases were merchant seamen.

The geographic source of infection for the 2,815 cases is shown in Table IV. Most infections (2,629) were acquired in Vietnam. Of the other countries where malaria was acquired, Pakistan accounted for 24 infections as compared with nine cases in 1966 and 10 cases in 1965. No notable increase of cases was observed from other malarious areas. Seventeen vivax infections were reportedly acquired in West Africa; the species diagnosis in seven of these cases was confirmed by the National Malaria Repository; and an additional three cases were diagnosed by other experienced laboratories. Individuals who develop malaria following travel in malaria endemic areas often visit more than one country. In those cases, it is seldom possible to determine with absolute certainty in which country the infection was acquired.

The onset of illness occurred more than 30 days after arrival in the United States in 80 percent of the 2,563 cases for which both date of onset and date of arrival in this country are known (Table V). A marked difference was observed between vivax and falciparum malaria: 56 percent of the falciparum cases became ill within one month after arrival, as compared with only 15 percent of the vivax cases. Twenty-six cases experienced their first symptoms more than one year after return to the United States: 25 of these were due to P. vivax, while P. falciparum was diagnosed in one case. The time interval between arrival in the United States and onset of illness in the 25 vivax cases varied from 12 to 36 months. The falciparum case became ill 404 days after his arrival.

Physicians in private practice diagnosed 218 of the 2,815 cases (7.7 percent); 325 cases were treated in Veterans Administrations Hospitals; and Public Health Service Hospitals admitted 30 cases. In total, 79.1 percent of all cases were admitted directly to military hospitals (Table VI). The rising number of malaria cases in veterans has increased the likelihood that civilian physicians will encounter patients with malaria. In 1966, only 35 cases occurred in veterans whereas in 1967, 267 cases were reported in veterans.

Primaquine therapy was reported to have been administered to 1,499 of the vivax cases which occurred in 1967, while no primaquine was given to 600 vivax cases. The relapse rate was 10.1 percent for cases who received primaquine and 21.2 percent for cases who did not receive primaquine.

During 1967, 390 individuals experienced a total of 470 malaria relapses. Of these 390 individuals, 314 had their primary attack in 1967, while 76 had their first illness in 1966. Thus, a total of 3,285 malaria attacks (2,815 primary attacks plus 470 relapses) was reported in 1967.

Table IV

Distribution by Plasmodium Species and Area of Acquisition of
Cases of Malaria, United States, 1967*

	<u>vivax</u>	<u>falciparum</u>	<u>malariae</u>	<u>ovale</u>	<u>Mixed</u>	<u>Unknown</u>	<u>Total</u>
AFRICA	27	20	1	15	-	5	68
Africa**	5	5	-	-	-	1	11
West Africa**	-	4	-	1	-	1	6
East Africa**	1	2	-	-	-	-	3
Chad	1	-	-	-	-	-	1
Congo	-	1	-	-	-	-	1
Ethiopia	2	-	1	-	-	-	3
Gabon	-	1	-	-	-	-	1
Ghana	1	2	-	1	-	-	4
Guinea	2	-	-	1	-	-	3
Kenya	1	1	-	-	-	-	2
Liberia	4	2	-	2	-	2	10
Mali	-	-	-	1	-	-	1
Morocco	-	-	-	1	-	-	1
Mozambique	-	-	-	2	-	-	2
Nigeria	9	1	-	3	-	-	13
Sierra Leone	1	-	-	3	-	-	4
Tanzania	-	-	-	-	-	1	1
Uganda	-	1	-	-	-	-	1
ASIA	2228	330	14	1	45	72	2690
Asia**	9	-	-	-	-	-	9
Southeast Asia*	2	-	-	-	-	-	2
India	3	-	-	-	-	-	3
Indonesia	2	-	-	-	-	-	2
Korea	3	-	-	-	1	-	4
Malaya	1	-	-	-	-	1	2
New Guinea	3	-	1	-	-	1	5
Pakistan	21	1	1	-	-	1	24
Philippines	6	-	-	-	-	-	6
Thailand	3	-	-	-	-	1	4
Vietnam	2175	329	12	1	44	68	2629
MID-EAST	2	-	-	-	-	-	2
Iraq	2	-	-	-	-	-	2
CENTRAL AMERICA AND CARIBBEAN	16	-	1	1	-	-	18
Central America**	2	-	-	-	-	-	2
El Salvador	1	-	-	1	-	-	2
Guatemala	4	-	-	-	-	-	4
Honduras	1	-	1	-	-	-	2
Nicaragua	3	-	-	-	-	-	3
Panama	5	-	-	-	-	-	5

Table IV continued next page.

Table IV (continued)

	<u>vivax</u>	<u>falciparum</u>	<u>malariae</u>	<u>ovale</u>	<u>Mixed</u>	<u>Unknown</u>	<u>Total</u>
SOUTH AMERICA	3	3	-	-	-	-	6
Brazil	1	3	-	-	-	-	4
Ecuador	1	-	-	-	-	-	1
Guiana	1	-	-	-	-	-	1
NORTH AMERICA	4	2	3	1	-	-	10
Mexico	1	1	1	-	-	-	3
United States	3	1	2	1	-	-	7
UNKNOWN	10	7	-	-	1	3	21
TOTAL	2290	362	19	18	46	80	2815

*Onset of illness in the United States and Puerto Rico

**Country Unspecified

Table V

Interval Between Onset of First Illness and Date of Entry into the U.S.
by Plasmodium Species, United States, 1967

Interval (Months)	Plasmodium Species								All Cases (%)	
	vivax	(%)	falciparum	(%)	malariae	(%)	ovale	(%)	Cases	(%)
Less than 1	323	(14.7)	190	(56.4)	2	(15.4)	-	(-)	515	(20.1)
1 - 2	1127	(51.3)	119	(35.3)	6	(46.1)	5	(35.7)	1257	(49.0)
3 - 6	548	(24.9)	21	(6.2)	3	(23.1)	7	(50.0)	579	(22.6)
7 - 12	176	(8.0)	6	(1.8)	2	(15.4)	2	(14.3)	186	(7.3)
1 year or more	25	(1.1)	1	(0.3)	-	(-)	-	(-)	26	(1.0)
All Cases	2199	(100.0)	337	(100.0)	13	(100.0)	14	(100.0)	2563	(100.0)

Table VI

Malaria Cases by Type of Hospital of Initial Admission
1967

Type of Hospital	No. of Patients	Percent
Military	2228	79.1
Civilian	218	7.7
Public Health Service	30	1.1
Veterans Administration	325	11.6
Not specified	14	0.5
Total	2815	100.0

IV. MALARIA IMPORTED FROM VIETNAM

Infections acquired in Vietnam accounted for 2,629 of the 2,808 imported cases (93.6 percent). Only six of these 2,629 cases did not occur in military personnel. P. vivax was the etiologic agent in 2,175 of the 2,629 cases (82.7 percent), P. falciparum in 329 cases (12.5 percent), P. malariae in 12 cases (0.5 percent), and P. ovale was found in only one case. Forty-four cases had a mixed infection (1.7 percent), and in 68 cases the Plasmodium species was not identified (2.6 percent). Forty-eight percent of the cases for which the information was available had a history of malaria while in Vietnam. Army personnel accounted for 93 percent of the military cases who became infected in Vietnam while three percent of the cases occurred in personnel of the Marine Corps. Navy and Air Force personnel represented less than one percent of the cases. (Table VII)

Of the 2,175 military returnees from Vietnam who developed vivax malaria in the United States in 1967, 295 had one or more relapses, i.e. a relapse rate of 13.7 percent; the corresponding rate for 1966 was 28.9 percent. The relapse rate for falciparum infections in military personnel returning from Vietnam in 1967 was 5.1 percent as compared to 8.6 percent in 1966.

Table VII

Military Malaria Cases from Vietnam, by Branch of Service,
United States, 1967

<u>Branch of Service</u>	<u>Number of Cases</u>	<u>Percent</u>
Army	2429	92.7
Marine Corps	82	3.1
Navy	6	0.2
Air Force	8	0.3
Unknown	98	3.7
Total	2623	100.0

V. MALARIA ACQUIRED IN THE UNITED STATES

Introduced Malaria

Cases 1 and 2

On June 9, 1967, a 23-year-old serviceman at Ft. Campbell, Kentucky, Sp4 T.F., experienced fever, headache, nausea, and vomiting. He was hospitalized in an Army hospital for these symptoms from June 11-16, and June 17-20, 1967; on both occasions the patient improved on symptomatic therapy and no definite diagnosis was made. On June 30, he developed fever, chills, and headache; he was readmitted on the following day and splenomegaly was then noted. Examination of a routine blood smear on July 5 revealed the presence of P. vivax parasites. On July 1, 1967, another, 19-year-old serviceman, Pfc. J.L., developed chills, sweating, headache, and fatigue. He was hospitalized on July 5, and P. vivax parasites were identified in a routine blood smear on July 6. Both diagnoses were confirmed by the National Malaria Repository, NCDC.

Neither patient had ever been in malarious areas and neither had a history of unexplained fever episodes, blood transfusions, or use of commonly shared syringes. The two patients had been together at Ft. Campbell only after May 12, 1967. There they worked in the Public Information Office of the U. S. Army Training Center, and they slept in adjoining bunks in their barrack, Building 3216 (Figure 3). The two men had never visited the same off-base localities except for two brief automobile trips together to a laundry just across the highway from the post. On the base itself, the only areas which both frequented were the Public Information Office in the daytime and their barrack in the evening hours.

Sixty-eight parasitologically confirmed vivax malaria cases had occurred at Ft. Campbell during April, May, and June of 1967; all had served in Vietnam. Extensive case detection at Ft. Campbell and in the surrounding civilian communities did not reveal any additional cases. Only five of the 68 vivax cases in the Vietnam returnees at Ft. Campbell had experienced their illnesses in proximity to the barrack of the two patients. Considering the extrinsic

incubation periods in May and June (29 and 10 days, respectively), it was found that only three of these individuals, Capt. E.H., Sgt R.S., and Sp4 T.N., could have served as index cases for the two patients (Figure 4).

An entomological survey revealed the presence of adult female Anopheles quadrimaculatus beneath the patients' and an adjoining barrack. In addition, larvae of A. quadrimaculatus were found in a marshy area about one-half mile from the patients' barrack (Figure 5). Mosquitoes had ready access to the barrack since most window screens, if present, were poorly fitted and frequently torn.

The following considerations suggest that the two men acquired their infection via mosquito transmission in their barrack during the spring of 1967: neither had ever been in a malarious area; neither gave a history of previous malaria, blood transfusions or commonly shared syringes; both had been at Ft. Campbell only since May 12, 1967; they had essentially no common off-base excursions; and their only common location after sundown (the feeding time of A. quadrimaculatus) was their barrack, where they were bunk mates. The presence of three possible index cases, and of adult and larval forms of A. quadrimaculatus within close proximity of their barrack supports this conclusion. In accordance with the W.H.O. terminology, the two cases have been classified as introduced.

(Reported by Dr. Calixto Hernandez, Medical Director, Division of Epidemiology, and Mr. J. Clifford Todd, Director, Field Investigations Unit, both with the Kentucky State Department of Health; Colonel Jules McNerney, MC, Commanding Officer, U. S. Army Hospital, and Captain Bryan Nelson, MC, Preventive Medicine Officer, both at Ft. Campbell, Kentucky; and a team from the Epidemiology and Aedes aegypti Eradication Programs, NCDC.)

Blood Transfusion Induced Malaria

Case 3

On December 21, 1966, a 62-year-old male resident of Oakland, California, was hospitalized in San Francisco for treatment of his myocardial infarction. During his hospitalization he developed anemia and was given two units of packed red cells, on March 4 and March 5, 1967. On March 12, he became febrile with spiking fevers up to 104° F. P. falciparum parasites were subsequently identified on a routine differential blood smear and antimalarial therapy was initiated. The patient had no history of malaria or commonly shared syringes. He had resided in Oakland since the mid-1940's. His only travel abroad was a brief trip to Mexico City in 1921.

Both donors of the packed red cells were servicemen. One of them had not been abroad and had no history of malaria; his serum contained no fluorescent antibodies to malaria. The other donor had returned from duty in Vietnam on June 26, 1966. He subsequently had several undiagnosed episodes of chills, fever, and sweating; the last episode occurred in January 1967. He donated blood in San Francisco on March 2, 1967, and this blood was given to the patient on March 4. The donor's serum contained fluorescent antibodies against P. falciparum in a titer of 1:80, but no parasites were found in his peripheral blood when examined between April 1 and 6. However, his bone marrow contained degenerated schizonts and malarial pigment.

(Reported by Dr. Philip K. Condit, Chief, Bureau of Communicable Diseases, Dr. Henry Renteln, Chief, Special Surveillance Unit, and Dr. Rebecca Proctor, all of the California State Department of Public Health; Dr. Richard E. Ferguson and Dr. Paul Isakson, San Francisco; Colonel Arthur Steer, MC, USA, Letterman General Hospital, San Francisco; Dr. Erwin H. Braff, Director, Division of Disease Control, San Francisco Department of Public Health.)

Case 4

In May 1967, a 55-year-old woman came to the United States from Hungary for treatment of idiopathic thrombocytopenia. Her illness was diagnosed in 1955; she underwent a splenectomy in 1956, and had been treated with corticosteroids since 1961. After her arrival she was admitted to a New York City hospital and between June 5 and 20, 1967, she received platelet transfusions from 121 donors and seven units of whole blood. On July 6, she developed fever and shaking chills. P. ovale parasites were found in her peripheral blood the next day. She responded favorably to chloroquine but died two weeks later from her underlying disease. The patient had no history of malaria or travel in malarious areas. Examination of sera from blood and platelet donors showed that one donor, a Nigerian male student, had fluorescent antibodies against all four human Plasmodium species in a dilution of 1:80, indicating past malaria infection from an undetermined species. This Nigerian donor did not have a history of malaria, and no parasites could be demonstrated in blood films obtained on two subsequent dates.

(Reported by Dr. Howard B. Shookhoff, Chief, Division of Tropical Diseases, New York City Health Department.)

Case 5

On February 25, 1967, a female infant was born in Bristol, Connecticut, following a normal pregnancy and delivery. Because of Rh incompatibility, she received two units of whole blood during the first 36 hours of life. She was healthy until three months of age when recurrent episodes of low grade fever developed. The child was hospitalized at six months of age and hepatosplenomegaly was then noted. Despite cultures and bone marrow studies, no definite diagnosis was made. The infant was discharged one week later. High fevers recurred within three weeks and the patient was rehospitalized on November 1, 1967. Antibiotic treatment was ineffective, and she was transferred to a New Haven hospital for further evaluation. Physical examination revealed a well developed, febrile, lethargic child with hepatosplenomegaly. An open liver biopsy and splenoportogram were performed and liver histology revealed swollen Kupffer cells containing dark pigment. Presence of this pigment prompted examination of peripheral blood films, and P. malariae parasites were then found. The patient responded promptly to chloroquine therapy.

The infant had never been outside Connecticut and her parents had no history of malaria or travel to malarious areas. The two donors of her exchange transfusions were identified and their sera examined. One donor was a 31-year-old Greek male, who had arrived in this country from Greece in 1966. He had no history of malaria or unexplained fever episodes and his serum contained no fluorescent antibodies against malaria. The other donor, a 32-year-old man from Oaxaca, Mexico, came to Connecticut in 1956 where he remained except for a brief visit to Mexico City in 1963. He had no history of malaria or unexplained fever episodes. Peripheral blood films did not show malaria parasites, but his serum contained fluorescent antibodies against malaria (P. malariae and P. vivax 1:160; P. ovale 1:80 and P. falciparum 1:10).

(Reported by Mr. David Barry, Medical Student, Yale University, School of Medicine; and Dr. Barbara W. Christine, Chief, Epidemiology Division, Connecticut State Department of Health.)

Congenital Malaria

Case 6

On June 2, 1967, a male child was born in California of Chinese parents following a full time pregnancy and normal delivery. The child was healthy until he developed fever of 104° F. for four days beginning on August 21, 1967. He was hospitalized on August 24, at which time hepatosplenomegaly and anemia were noted. P. malariae parasites were detected in a peripheral blood film.

The parents migrated to the United States from South China via Hong Kong in 1959. The 31-year-old mother had had malaria at 6 years of age, but had not had any symptoms suggestive of malaria since that time. The 28-year-old father also had had malaria during childhood, and his last attack occurred in 1943. The patient's 3-year-old sister had no history of unexplained fevers; blood smears obtained from her in August 1967 did not contain malaria parasites.

Careful review of maternal peripheral blood films taken in August 1967 revealed one to two schizonts of P. malariae per slide. Neither mother nor child had ever received any blood transfusion

(Reported by Dr. B. Harvey, Pediatrician, Palo Alto; Dr. J. Remington, Associate Professor of Medicine, Stanford University; Dr. Philip K. Condit, Chief, Bureau of Communicable Diseases, and Dr. Henry Renteln, Chief, Special Surveillance Unit, both with the California State Department of Public Health.)

Cryptic Case of Malaria

Case 7

On July 9, 1967, a 41-year-old married male carpenter in Bowling Green, Kentucky, developed malaise, myalgia, chills, and fever. Tetracycline treatment was ineffective and he was hospitalized on July 12, at which time the physician, the pathologist, and the laboratory technician each identified P. vivax parasites in peripheral blood films. Chloroquine therapy was instituted and the patient became afebrile within 48 hours. The original blood films were not available for review, but serum collected on August 24, 1967, contained fluorescent antibodies against P. vivax in a dilution of 1:80, thus supporting the diagnosis of vivax infection. (The titers against P. ovale, P. malariae, P. falciparum, were 1:20.)

The patient gave a history of possible malaria in the mid-1940's but had had no subsequent febrile illnesses. He denied blood transfusions, recent injections or use of commonly shared syringes. He lived in a well screened, air-conditioned, modern, suburban home. His only travel outside Bowling Green after May 1, 1967, included a night of fishing on June 6 at Barkley Lake, Kentucky (100 miles west of Bowling Green), and a fishing excursion on June 20 to Barren Reservoir Dam (20 miles east of Bowling Green).

Family members and two constant fishing companions of the patient were interviewed; one of the fishing companions had a history compatible with malaria but blood and serum examinations were negative. The 103 general practitioners, pediatricians, and internists of the 12 Kentucky counties included in the area of his travels during June were interviewed to detect patients with unexplained fever episodes

after June 1, 1967; 12 such persons were identified but blood and serum examinations did not indicate past or present malaria infection in any of these patients. Three men who frequently fished at Barren Reservoir and two men who habitually fished at Barkley Lake were interviewed but none had a history suggestive of malaria. Adult female A. quadrimaculatus had been found regularly at Barkley Lake from May 29 through July 1, 1967. No mosquito surveillance activities were performed at Barren Reservoir or at Bowling Green.

The patient's history suggested that his malaria infection could have been acquired by mosquito transmission. Despite extensive investigation no associated secondary cases were found, and no index case could be identified. No relationship could be demonstrated between the patient in Bowling Green and the episode of malaria transmission at Ft. Campbell in May-June of 1967. In accordance with WHO nomenclature, this case was classified as cryptic.

(Reported by Dr. Calixto Hernandez, Director, Division of Epidemiology, Dr. J. W. Skaggs, Acting Director, Office of Communicable Disease, and Mr. J. Clifford Todd, Director, Field Investigations Unit, all with the Kentucky State Department of Health; and a team from the Epidemiology Program, NCDC.)

VI. DEATHS DUE TO MALARIA IN THE UNITED STATES

Case 1

On August 14, 1967, a 20-year-old serviceman who was on temporary leave in Hawaii from duty in Vietnam developed chills and fever. Two days later he was admitted to the hospital and found to have nuchal rigidity, trismus, hepatosplenomegaly, bilateral Babinski's reflexes, and hyperactive, bilateral, deep tendon reflexes. Within an hour after admission, the patient became semicomatose and disoriented; a blood film revealed a 10 percent parasitemia with P. falciparum. The patient developed hemolysis as evidenced by a decrease of the hemoglobin from 13.7 to 9.8 gm. percent between August 16 and 19, a bilirubin value of 3.0 mg. percent, and hemolysed serum. Spinal fluid pressures were at the upper limits of normal; EEG changes were compatible with a diffuse, acute destructive process. Chest X-rays showed pulmonary edema and pneumomediastinum. The parasite count on August 17 was 50,400 per mm³.

The patient was given 650 mg. of quinine intravenously and 250 mg. of chloroquine every eight hours. Because of anuria, fluids and mannitol were administered. Dexamethasone, cephalothin, and heparin were also given. The patient failed to respond to therapy and died on August 19. Autopsy revealed cerebral malaria with edema, pulmonary congestion and edema with bilateral hydrothorax, and acute congestion of the spleen, liver, and kidneys.

(Reported by Captain Alvin E. Smith, MC, USA, and Captain Robert McNamara, MC, USA, Tripler General Hospital, Hawaii; and Dr. Robert Penington, Jr., Chief, Epidemiology Branch, Hawaii State Health Department.)

Case 2

On November 16, 1967, a 43-year-old married male civilian airline flight engineer arrived in New York City from Lisbon, Portugal. He was severely ill upon arrival, complaining of high fever, chills, and lethargy. On November 21, he was admitted to a hospital in Wilmington, Delaware; his temperature was 103° F. and he was disoriented and jaundiced. Two days later he became comatose. Between November 22 and 24, the hemoglobin dropped from 12.5 gm. percent to 8.1 gm. percent, the BUN

increased from 33 to 82 mg. percent, and the bilirubin rose from 3.6 to 10 mg. percent. On November 24, a blood film revealed a 50 percent parasitemia with P. falciparum. The patient expired the same day, before specific antimalarial therapy could be instituted. Autopsy findings included markedly edematous lungs; a soft, hemorrhagic, enlarged spleen; moderate cerebral congestion; and widespread presence of P. falciparum parasites in the capillaries of every examined organ system, including the brain.

From April 17 to September 16, 1967, the patient had been working for a commercial airline in Europe. Between October 26 and November 8, 1967, the period that he may have acquired his P. falciparum infection, he made several trips from Lisbon, Portugal, to Portuguese Guinea and Sao Tome (an island approximately 250 miles south of Port Harcourt on the west coast of Africa), and possibly to other West African areas.

The patient probably acquired his infection in West Africa but did not become ill until the time of his return to the United States.

(Reported by Dr. G. K. Berger, Wilmington, Delaware; Dr. F. I. Hudson, Executive Secretary and State Epidemiologist, and Dr. E. P. Gliwa, Deputy State Health Officer, both with the Delaware State Board of Health; and an EIS Officer.)

VII. REPORT FROM THE NATIONAL MALARIA REPOSITORY - 1967

The diagnosis of the Plasmodium species was confirmed in blood films from 2,083 of the 2,204 cases (94.5 percent) in which slides were reviewed at the NCDC. In 39 cases (1.8 percent) the NCDC Laboratory diagnosed a different Plasmodium species. In only four cases (0.2 percent) malaria parasites were found in slides which were submitted as having no parasites present. Examination of smears from 78 cases (3.5 percent) failed to confirm the presence of any parasites.

Although improper preparation of slides from only 8 cases (0.4 percent) precluded adequate species identification, approximately one-half of the 4,000 slides submitted had to be restained before adequate examinations could be made.

VIII. ACKNOWLEDGMENT

The Malaria Surveillance Report, prepared annually at the National Communicable Disease Center, is based on information provided on individual case reports. The tremendous support given to the malaria surveillance program by State and local health departments and personnel of the Preventive Medicine Services of the U. S. Army, Navy, and Air Force is greatly appreciated. We are especially grateful to Dr. William E. Collins of the Laboratory of Parasite Chemotherapy, NIAID, NIH, for performing the fluorescent antibody tests noted in the report.

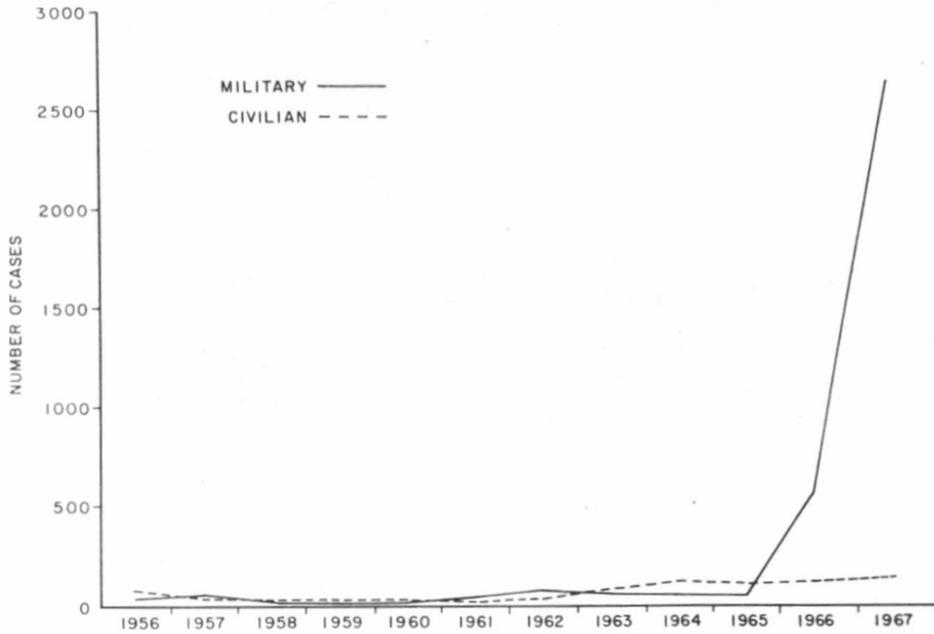
Thorough and comprehensive evaluation of all cases of malaria reported in the United States constitutes the most effective approach to preventing re-establishment of malaria transmission subsequent to importation.

All cases of malaria, regardless of where they are acquired, should be promptly reported to the appropriate health department. Clinical and epidemiological information on each case should be provided on the Malaria Case Surveillance Report Form PHS 4.80 (CDC). Extra copies of this form are available on request. Every effort should be made to obtain thick and thin blood films for each case. These films may be submitted with the Surveillance Form. Blood films not only enable diagnostic confirmation but also serve, in the event of relapse or reinfection, as reference to previous disease.

REFERENCES

1. Terminology of Malaria and of Malaria Eradication. World Health Organization, 1963, p. 32.
2. WHO Expert Committee on Malaria - Tenth Report. WHO Technical Report Series No. 272, p. 34.

Figure 1
MILITARY AND CIVILIAN CASES OF MALARIA
UNITED STATES, 1956-1967



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Figure 2
GEOGRAPHIC DISTRIBUTION OF MALARIA CASES
WITH ONSET IN THE UNITED STATES-1967

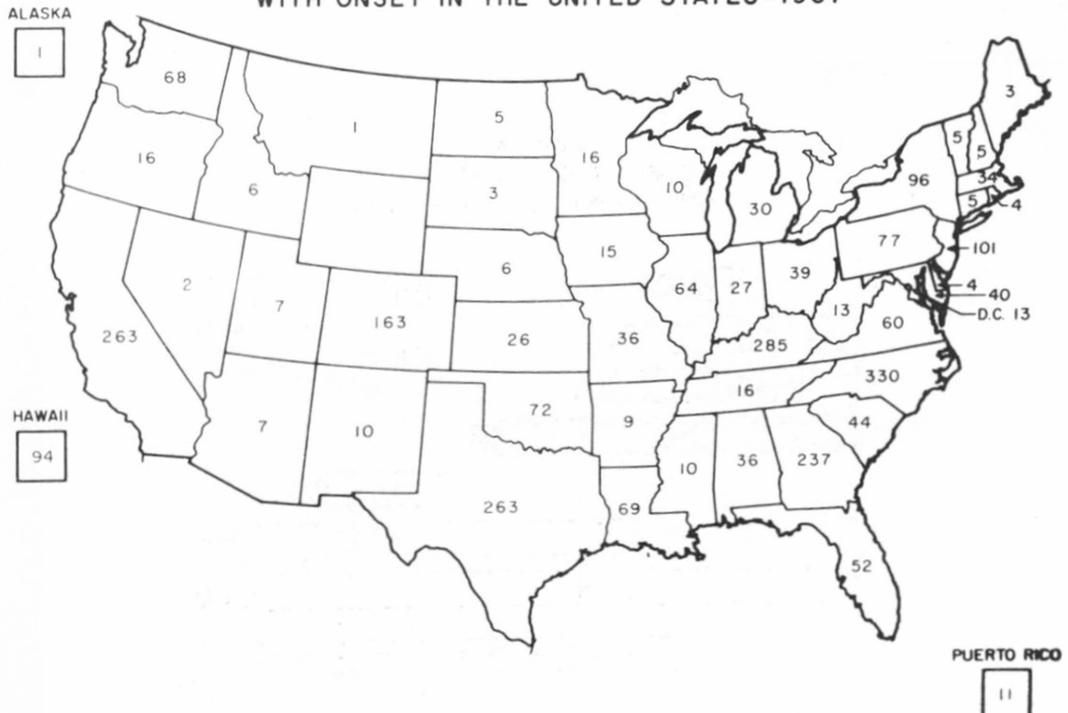


Figure 3
CANTONMENT AREA - FT. CAMPBELL, KENTUCKY

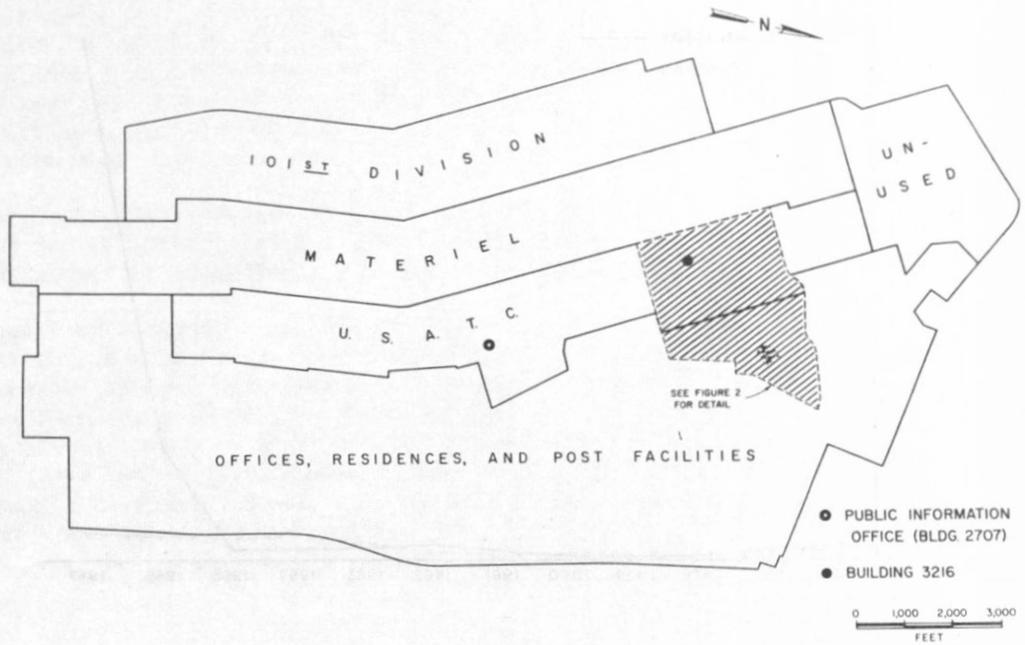


Figure 4
MALARIA CASES IN U.S.A.T.C. AREA
FORT CAMPBELL, KENTUCKY, 1967

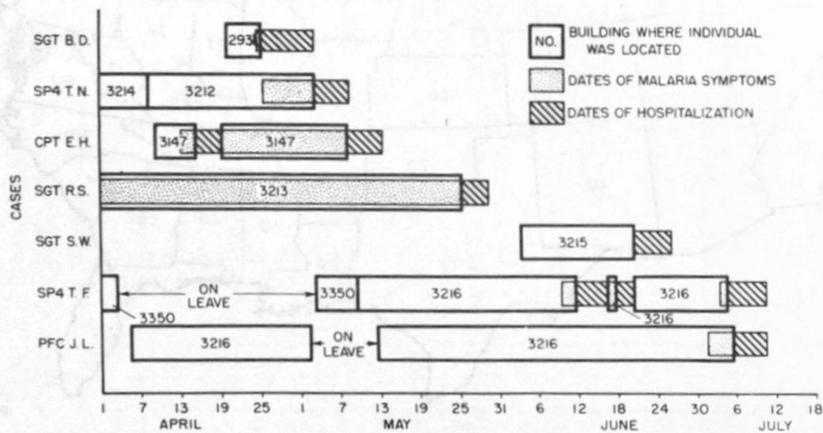
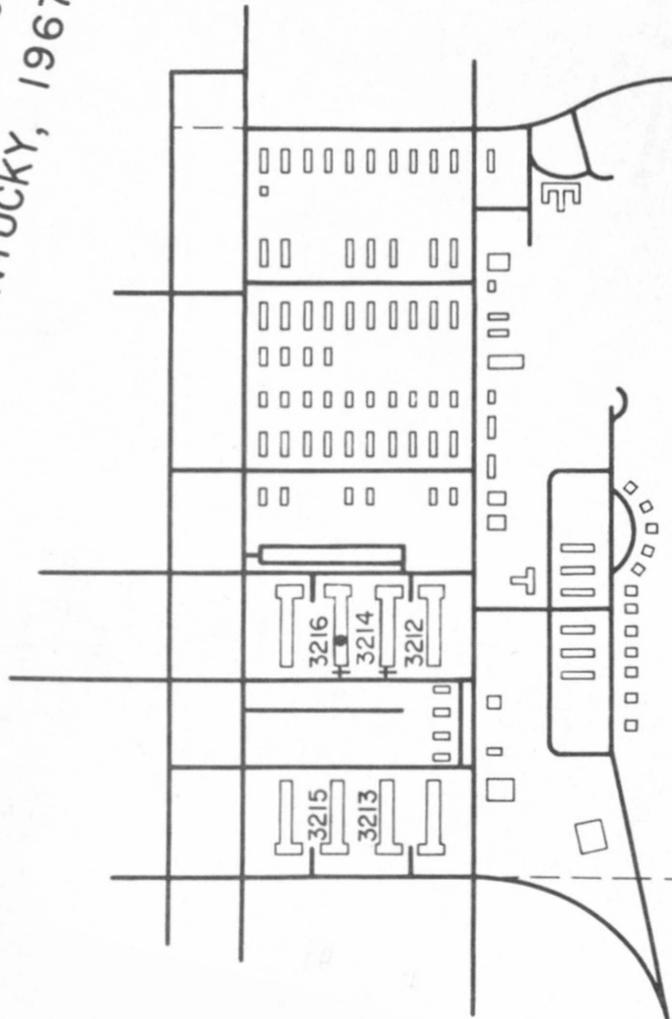
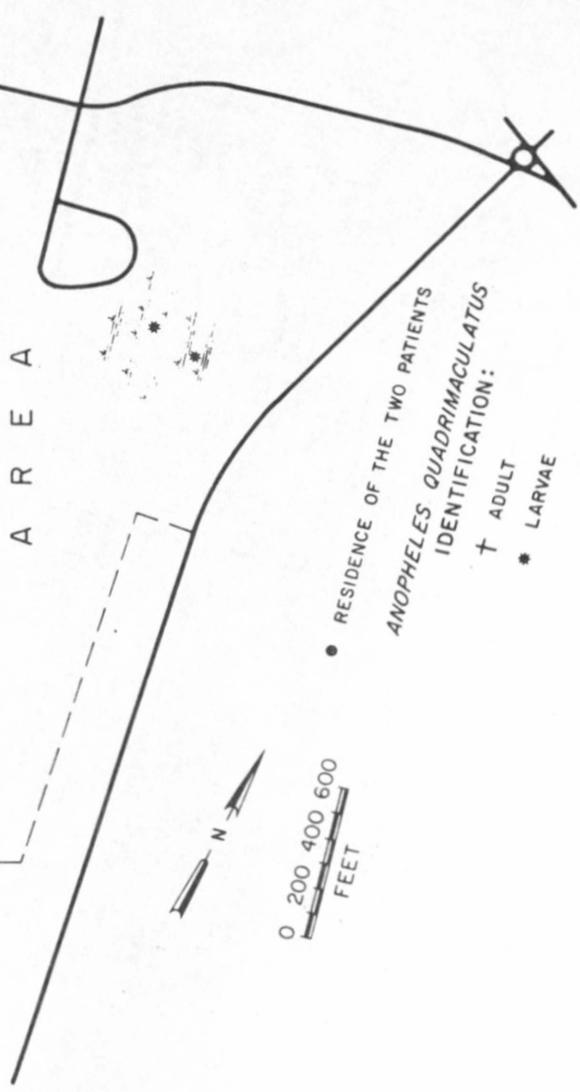


Figure 5
AREA OF MALARIA TRANSMISSION
FORT CAMPBELL, KENTUCKY, 1967



W O O D E D
A R E A



● RESIDENCE OF THE TWO PATIENTS
ANOPHELES QUADRIMACULATUS
† ADULT
* LARVAE

0 200 400 600
FEET



STATE EPIDEMIOLOGISTS

Key to all disease surveillance activities are those in each State who serve the function as State epidemiologists. Responsible for the collection, interpretation and transmission of data and epidemiological information from their individual States, the State epidemiologists perform a most vital role. Their major contributions to the evolution of this report are gratefully acknowledged.

Alabama	W. H. Y. Smith, M.D.
Alaska	Donald K. Freedman, M.D.
Arizona	Melvin H. Goodwin, Ph.D.
Arkansas	J. T. Herron, M.D.
California	Philip K. Condit, M.D.
Colorado	C. S. Mallohan, M.D.
Connecticut	James C. Hart, M.D.
Delaware	Floyd I. Hudson, M.D.
D. C.	William E. Long, M.D.
Florida	E. Charlton Prather, M.D.
Georgia	John E. McCroan, Ph.D.
Hawaii	Robert Pennington, Jr., M.D.
Idaho	John A. Mather, M.D.
Illinois	Norman J. Rose, M.D.
Indiana	A. L. Marshall, Jr., M.D.
Iowa	Arnold M. Reeve, M.D.
Kansas	Don E. Wilcox, M.D.
Kentucky	Calixta Hernandez, M.D.
Louisiana	Charles T. Caraway, D.V.M.
Maine	Dean Fisher, M.D.
Maryland	John H. Janney, M.D.
Massachusetts	Nicholas J. Fiumara, M.D.
Michigan	George H. Agate, M.D.
Minnesota	D. S. Fleming, M.D.
Mississippi	Durwood L. Blakey, M.D.
Missouri	E. A. Belden, M.D.
Montana	Mary E. Soules, M.D.
Nebraska	Lynn W. Thompson, M.D.
Nevada	Mark L. Heman, M.D.
New Hampshire	William Prince, M.D.
New Jersey	Ronald Altman, M.D.
New Mexico	Logan Roots, M.D. (Acting)
New York State	Julia L. Freitag, M.D.
New York City	Vicent F. Guinee, M.D.
North Carolina	Martin P. Hines, D.V.M.
North Dakota	Kenneth Mosser, M.D.
Ohio	Calvin B. Spencer, M.D.
Oklahoma	R. LeRoy Carpenter, M.D.
Oregon	Edward Press, M.D.
Pennsylvania	W. D. Schrack, Jr., M.D.
Puerto Rico	Carlos N. Vicens, M.D.
Rhode Island	William Schaffner, II, M.D. (Acting)
South Carolina	G. E. McDaniel, M.D.
South Dakota	G. J. Van Heuvelen, M.D.
Tennessee	C. B. Tucker, M.D.
Texas	M. S. Dickerson, M.D.
Utah	Robert Sherwood, M.D.
Vermont	Linus J. Leavens, M.D.
Virginia	Paul C. White, M.D.
Washington	B. John Francis, M.D.
West Virginia	N. H. Dyer, M.D.
Wisconsin	H. Grant Skinner, M.D.
Wyoming	Herman S. Parish, M.D.